



New Generation Continuous Air Monitors

The Challenge

The Hanford double-shell and some single-shell waste tanks have active forced-air ventilation systems to provide cooling and radiological contamination control. For the protection of personnel and the environment, the exhaust streams from these systems are monitored for potential release of radioactive contaminants. In addition, the vent stream of each tank annulus (space between the shells of a double-shell tank) is monitored ahead of the integral filtration systems for the presence of radioactive contaminants. The presence of contaminants in the tank annuli would be an indication of a potential loss of primary waste tank containment (leak). The instrument commonly used for this monitoring is a Continuous Air Monitor (CAM).



New AMS-4 CAM instrument display and the remote computer monitor (inset).

Current Approach

The monitoring system consists of a sample collection probe, sample lines for air sample transport and a vacuum pump for motive force. The CAM collects particulates on a filter inserted into the sample air stream that is, in turn, monitored by a radiation detector. The filter serves to accumulate or totalize particulates and concentrate any contaminants in the sample stream. The CAMs presently in service in the tank farms are Eberline Model AMS-3 and are based on old technology. The radiation detectors are Geiger-Mueller (GM) tubes that are unable to discriminate gamma radiation from beta particles which is the radiation of primary interest. Heavy lead shielding is used to prevent unwanted background gamma from entering the detector and this results in an instrument that weighs 160 pounds. Since the CAMs are removed once per year as a minimum from the field for calibration, this presents a safety hazard to the worker when lifting the CAM from the vertical storage racks. In addition, the electronics provide only a single measurement parameter – total filter counts per minute. This measurement does not consider the rate of radionuclide deposits or the short-term collection concentration in the sample stream. There are no statistical calculations performed on the data to determine significance before being able to make decisions on alarm set points. Alarm functions with the existing AMS-3 CAM are limited to high radiation level and detector failure.

Benefits and Features

- ◆ Resolves employee safety concern (heavy lifting)
- ◆ More reliable operation and increased accuracy
- ◆ Reduced calibration time
- ◆ Increased visibility for equipment problems and off-normal conditions
- ◆ Remote interrogation of CAM status

New Technology

The existing CAMs are being replaced with Eberline Model AMS-4 CAMs. The new instruments utilize microprocessors to provide statistical analysis evaluation of the data to determine significance before making alarm decisions. The detectors are capable of discriminating between gamma radiation and beta particles. The detectors do not require heavy lead shielding to block the background gamma radiation. The CAM has a remote in-line detector unit that can be separated from the electronics and readout display. Each unit weighs less than 10 pounds compared to 160 pounds for the current CAMs and is much safer for workers when lifting during maintenance and annual calibration.

The new CAMs incorporate a mass flow sensor and measure the flow rate of the sample stream passing through the detector chamber. The flow rate and the rate of change of radiation on the filter are used to calculate actual sample stream concentrations of radioactivity. The measured radiation can be displayed as the total accumulated amount on the filter or as a concentration in the stream. The concentration measurements have user-selectable time duration constants. The user can select any or all of the measurements for radiation alarm set points. A separate instrument failure alarm is also composed of user-selectable parameters

including detector failure and low sample flow rate. A computer port allows remote interrogation of the unit's status. All user-selectable parameters can also be modified via a remote work station computer. Calibration of the detector is done under internal processor control and can be performed in much less time than with the old technology. A calibration report is also available upon request via a printer port for convenience in maintaining the instruments. The remote computer workstation has not been implemented but provides an opportunity for additional future system enhancement and cost savings.

Information Contacts

C. C. Scaief, Lockheed Martin Hanford Corporation –
Equipment Engineering (509) 376-0491
G. T. Frater, FDH Technology Management
(509) 372-4291
D. A. Brown, DOE-RL Science and Technology
Programs, (509) 372-4030

Technology Vendor

Eberline Instruments
504 Airport Road
Santa Fe, NM 87505
(505) 471-3232



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